FIRST IN ELECTRON-OPTICS

PRECISION

COMPONENTS

BEAM CONTROL DEVICES

FOR THE ELECTRONICS INDUSTRY

Constantine Engineering Laboratories Company

"For the latest in the science of Electron Beam Control"

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Celco

PRODUCTS FOR DISPLAY ENGINEERING

DEFLECTION YOKES

FIXED
ROTATING
COMBINATIONS

FOCUS COILS

STATIC
DYNAMIC
IRROTATIONAL

FIELD CORRECTORS

PIN CUSHION
ASTIGMATIC
LINEARITY

CENTERING COILS

ALIGNMENT
CENTERING
BEAM BENDING

SOLID STATE AMPLIFIERS

WIDE BAND DEFLECTION
LINEARITY CORRECTION
TV AND REPETITIVE SCAN

MEASURING INSTRUMENTS

TWO-SLIT SPOT ANALYZER
X-Y TRAVELING MICROSCOPE
PHOSPHOR ANALYSIS

SUB-SYSTEMS

INTEGRATED CRT PACKAGE
MAGNETICALLY SHIELDED SYSTEMS
SPOT GROWTH GUARANTEES

DEFLECTRONS

HIGH RESOLUTION
SUPER RESOLUTION
COLOR

SPECIAL CORE YOKES

CELCALLOY
NICKEL IRON
FERRITE

STORAGE TUBE COILS

SCAN CONVERTERS
CHARACTER
SATELLITE

CAMERA COILS

VIDICON
IMAGE ORTHICON
IMAGE DISSECTOR

POWER SUPPLIES

REGULATED
HIGH VOLTAGE
SPECIAL

ADJUSTING MECHANISMS

MICRO-POSITIONERS
LOW COST POSITIONERS
MICROSCOPE AND POSITIONER BEDS

CELCO ENGINEERING SERVICES

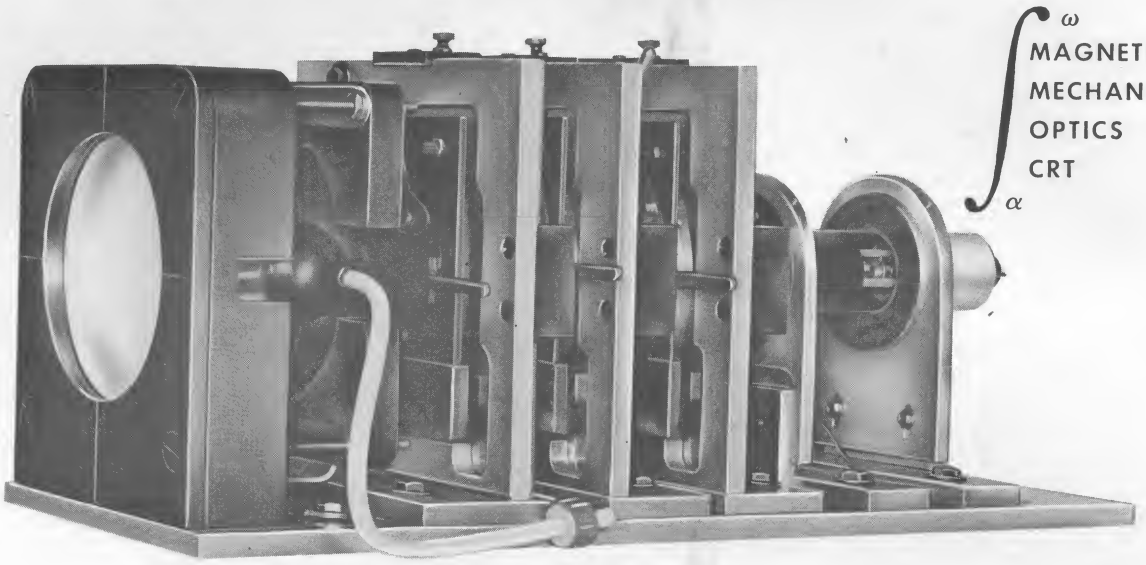
APPLICATION NOTES
CUSTOMER CONSULTATION
ENGINEERING EVALUATION

CALL FOR ENGINEERING CONSULTATION

Celco

NEW DISPLAY PRECISION

A NEW CONCEPT AND APPLICATION



MICRO-POSITIONER DISPLAY UNIT

for

MICRO-CONTROL OF DEFLECTION AND CORRECTIVE FIELDS

Minimum Spot Distortion — Minimum Spot Growth — Parameters Measured

Line Straightness to Specification — Full Electron-Optical Evaluation

Operating Procedure Manual Supplied — Completely Assembled by CELCO

Each Unit Laboratory Adjusted to Your CRT

UNIQUE DESIGN OVERCOMES GIMBAL MOUNT DISADVANTAGES

NO BACKLASH IN PITCH AND YAW

MAXIMUM LONG-TERM STABILITY
WITH POSITIVE LOCKING IN ALL POSITIONS

SIX INDEPENDENT DEGREES OF FREEDOM

HORIZONTAL TRANSLATION — VERTICAL TRANSLATION

AXIAL POSITIONING — ROTATION — PITCH — YAW

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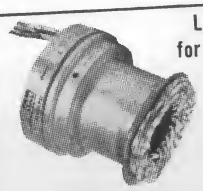
Celco STANDARD DEFLECTION YOKES

AND CRT COMPONENTS

Low cost stator type yoke for high grade commercial applications

TYPE KY



Low LI^2, high sensitivity for 42°, 52°, 70° and 90° 1 7/16" CRT neck

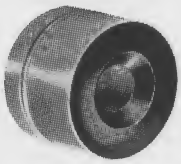
TYPE FY

High quality general purpose, moderate resolution low residual, for 52°, 70° and 90° 1 7/16" CRT neck

TYPE AY

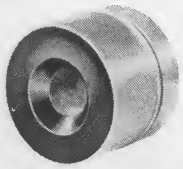
Fast core general purpose, moderate resolution, for 52°, 70° and 90° 1 7/16" CRT neck

TYPE HY



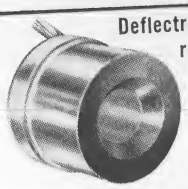
Deflectron®, high resolution general purpose for 42° 1 7/16" CRT neck

TYPE HD



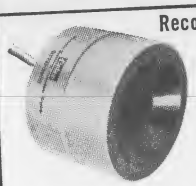
Fast core, low LI^2, low distributed capacity for 52° 1 7/16" CRT neck

TYPE GD



Deflectron® for high resolution recording storage tubes Scan converter applications

TYPE QD



Recording storage tube yoke Scan converter applications

TYPE QY

Writing yoke for high frequency beam modulation Celcaloy, ferrite and air core for 1 7/16" CRT neck

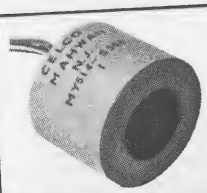
TYPE AW

General purpose yokes

for 7/8" CRT neck **BY**

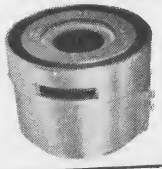
1" storage tube **CY**

for 1 1/8" storage tube **CYT**



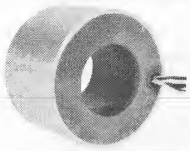
Miniature yoke for 7/8" CRT neck and special unit construction

TYPE MY



Rotating yoke for 52° and 70°, 1" and 1 7/16" CRT necks Includes bearings, gear and sliprings

TYPE RY



Low resistance version of type BY

Available for types CY and CYT

TYPE YY

Character and storage tube yoke

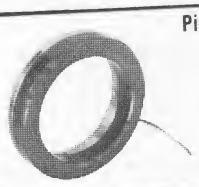
for 2" CRT neck Type DY

2 1/4" CRT neck Type DJ

TYPE DY

Coils for centering and beam alignment, aiming, flooding for 1 7/16" CRT neck

TYPE KC



Pincushion corrector, electromagnetic, low cost, general purpose

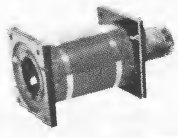
TYPE L

Pincushion corrector, permanent magnet Specials available

TYPE M

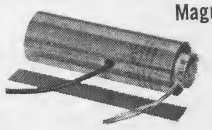
Focus coil, dynamic for high resolution Many other standard types available

TYPE HLF



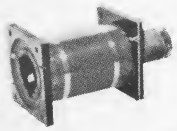
Vidicon yoke, focus and alignment coils 1" For slow scan, high resolution

TYPE WV



Hybrid vidicon yoke, 1" Magnetic deflection coil with shielding

TYPE HV



Vidicon yoke, focus and alignment coil 1" For standard TV applications

TYPE TV 129

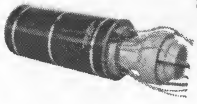


Image Orthicon yoke, focus and alignment coils 3" For high resolution, slow scans

TYPE AV 172

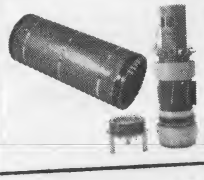
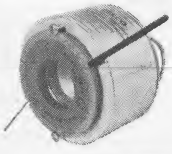


Image Orthicon yoke, focus and alignment coils 3" For standard TV applications

TYPE TV 172



Static astigmatic corrector and dynamic focus coil For high resolution 42° CRT

TYPE NC

Celco

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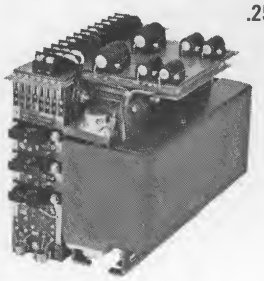
Celco X-Y DEFLECTION AMPLIFIERS

AND SOLID STATE DEFLECTION CIRCUITRY

X-Y Deflection Amplifier
.25% Linearity



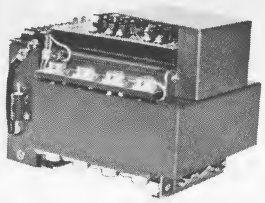
DA-PP2B
± 1.5 amp
(shown)

DA-PP3B
± 3.0 amp

DA-PP6B
± 6.0 amp

For Yokes over 100 μh

X-Y Deflection Amplifier
.25% Linearity



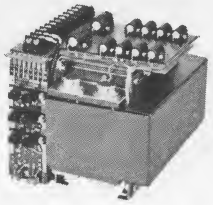
DA-PP2C
± 1.5 amp

DA-PP3C
± 3.0 amp

DA-PP6B
± 6.0 amp
(Shown)

For Yokes under 100 μh

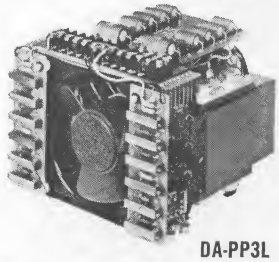
Ultra Linear X-Y Deflection Driver
.05% Linearity



DA-PP3D

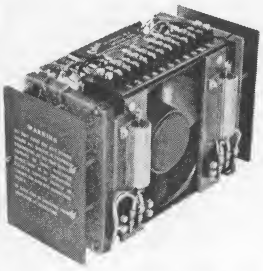
For High Precision Displays

Linearity Correction for Flat-Faced CRT
Use with CELCO Field Corrector
for absolute linearity



DA-PP3L

All Silicon NPN Deflection Driver

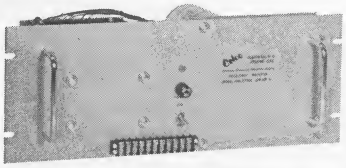


DA-PP3N
± 3.0 amp
(Shown)

DA-PP6N
± 6.0 amp

For Highest Precision Displays

Rack Mounted X-Y Deflection Amplifier
Unregulated Power Supply



PDA-PP2BR
± 1.5 amp

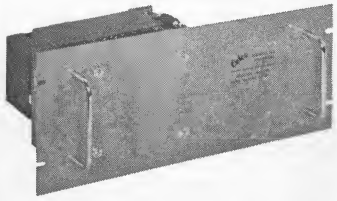
PDA-PP3BR
± 3.0 amp
(Shown)

Rack Mounted X-Y Deflection Amplifier
Regulated Power Supply
Isolated X-Y Channels

RDA-PP3B
± 3.0 amp
(Shown)

RDA-PP6B
± 6.0 amp

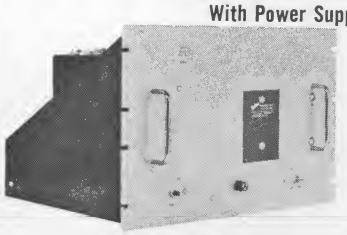
All Silicon Deflection Amplifier
Regulated Power Supply



RDA-PP3N
± 3.0 amp
(Shown)

RDA-PP6N
± 6.0 amp

High Speed Deflection Driver
Single Axis Push-Pull
With Power Supply

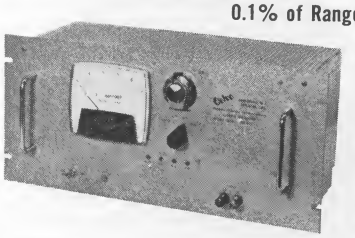


1-PDA-PP 18N

18 KV
Accelerating Potential

10 μs
70° Deflection

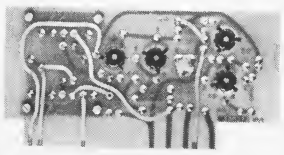
Constant Current Sources
0.1% of Range



CR-104
4.0 amp 10.0V
(Shown)

CR-510
10.0 amp 5.0V

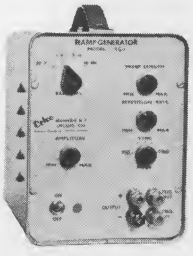
Vidicon Driver and Sweep Generator
for Hybrid Tube Type 8134



DA-V1

Use with Celco Vidicon Yoke Type HV

Sawtooth Signal Generator SG1
Ramps from 20 μs to 100 ms



Triggers in and out

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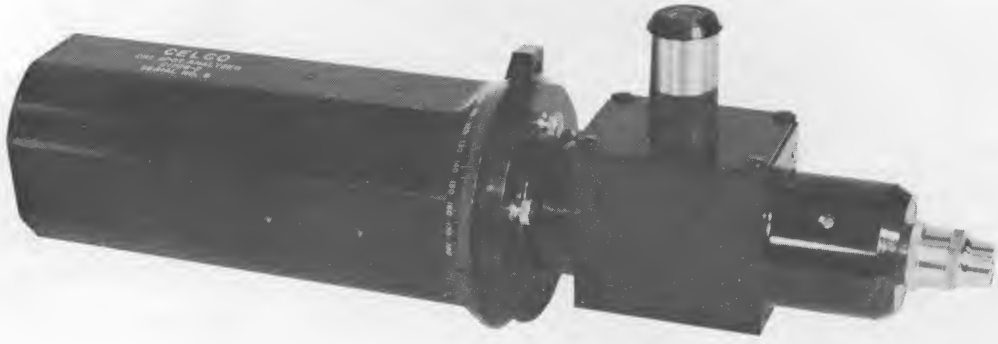
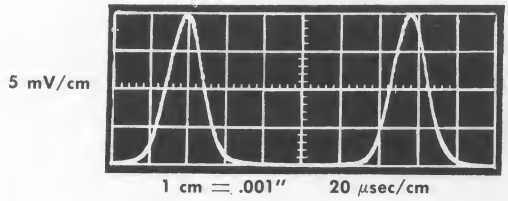
Celco TWO-SLIT SPOT ANALYZER

FOR DETERMINATION OF CRT SPOT CHARACTERISTICS

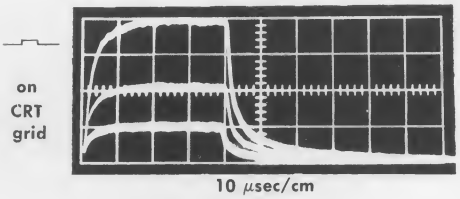
With the CELCO Two-Slit CRT Spot Analyzer –a scientifically designed and fully calibrated instrument– high standards of resolution may now be specified.



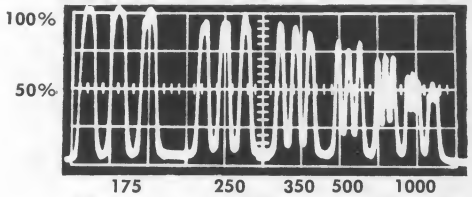
HALF AMPLITUDE SPOT DIAMETER



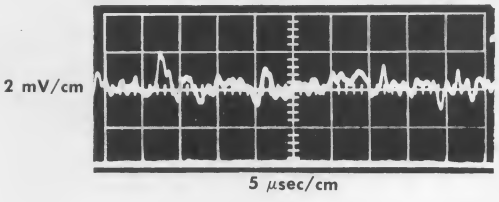
PHOSPHOR RISE and DECAY TIME



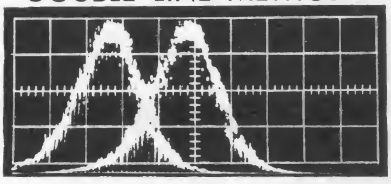
CONTRAST RATIO BAR CHART



P11 PHOSPHOR or FACE NOISE

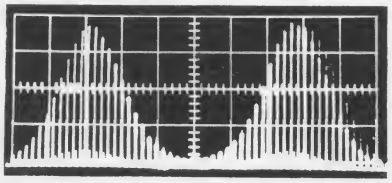


DOUBLE LINE METHOD



(2 line raster parallel to single slit)
3 sweep signals needed, raster must be moved vertically. Measurement of line spacing must be made on CRT face

TWO-SLIT METHOD



(Single line raster parallel to slit pair)
Only 2 sweep signals required.
Distance calibration is locked into analyzer. No measurement on CRT face

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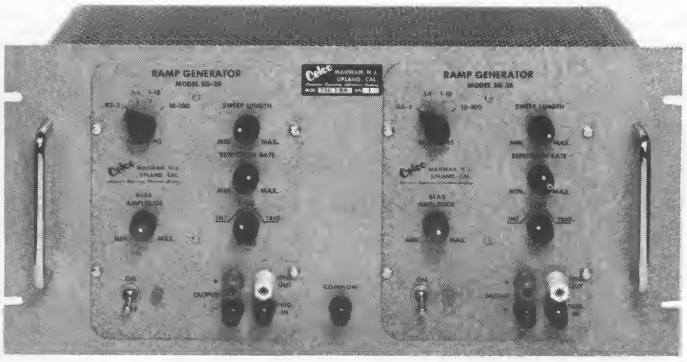
PRECISION Celco COMPONENTS

RAMP GENERATORS

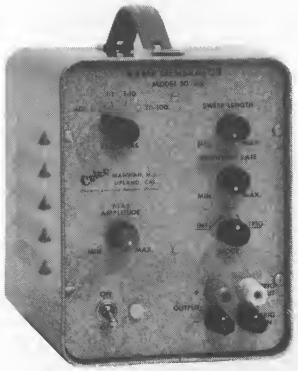
Sweeps From 20 μsec to 100 msec (Optional Range to Seconds)

Multiple Combinations of Ramps, Bias Voltages, Triggers
Wide Selection for Lab, Breadboard, Test, Display



- **All Solid State**
- **Linearity better than 0.5%**
- **Four Overlapping Sweep Ranges**
- **External Triggering or Sync**
- **Two Separate Units Produce Rasters**
- **Available in Single Rack Units**
- **Compatible with CELCO Amplifiers**

STANDARD TYPES



SG-1	Single Ramp Generator — 100 ohms minimum load.
SG-1C	Single Unit with additional optional range to seconds
SG-2B	Single Unit with continuously variable bias to ±5 volts about ground. Output Impedance adjusted to 1000 ohms for compatibility with CELCO Deflection Amplifiers.
SG-IBR	Two Units in standard rack panel with adjustable bias to 5 volts below ground. 1000 ohms output impedance.
2SG-2BR	Two Units in Standard rack panel with adjustable bias ±5 volts about ground. 1000 ohms output impedance.

Celco YOKES

Constantine Engineering Laboratories Company

"For the latest in the science of Electron Beam Control"

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TWX 714-556-9550

SOUTHERN DIVISION
Miami, Florida
Tel. 305-751-1132

EASTERN DIVISION
Mahwah, New Jersey
Tel. 201-327-1123
TWX 201-327-1435

RAMP GENERATORS

	2SG-1BR	2SG-2BR	SG-2B	SG-1C
VOLTAGE OUTPUT	0-9 volts peak-to-peak into 10K ohm load			0-10 volts p-to-p into 100 ohm load
OUTPUT IMPEDANCE	1000 ohms	1000 ohms	1000 ohms	< 10 ohms
SWEEP PERIODS	4 ranges 1. 20 to 100 μsec 2. 100 to 1000 μsec 3. 1 to 10 msec 4. 10 to 100 msec	4 ranges 1. 20 to 100 μsec 2. 100 to 1000 μsec 3. 1 to 10 msec 4. 10 to 100 msec	4 ranges 1. 20 to 100 μsec 2. 100 to 1000 μsec 3. 1 to 10 msec 4. 10 to 100 msec	5 ranges Additional optional range to seconds
DUTY CYCLE	Continuously variable from 10% to 90% of maximum sweep period. Amplitude independent of duty cycle setting			
LINEARITY	Sweep slope constant within ±0.5% (Ranges 1 through 4 only)			
OPERATING MODES	Three modes determined by mode selector switch. 1. Internal: Internal circuits provide all functions. All controls active. 2. Sync: Internal circuits provide all functions but main oscillator synchronized with external pulse. 3. Triggered: One sweep only for each trigger pulse. Sweep length and amplitude under internal control.			
SYNC	Sync or trigger input pulse must be positive going and between +2 to +12 volts with a rise time less than 1 microsecond			
CONNECTIONS	All inputs and outputs made at front panel via 5 way binding posts on ¾ inch centers. Ground terminal is floating with respect to chassis.			
INPUT POWER	115V, 60Hz at 200 mA		115V, 60Hz at 100 mA	
SIZE	19" W x 8¾" H x 8" D		6⅛" W x 8" H x 8" D	
WEIGHT	10 pounds		6 pounds	

SPECIFY CELCO YOKES AND AMPLIFIERS

Radar

Experimental and Development Projects

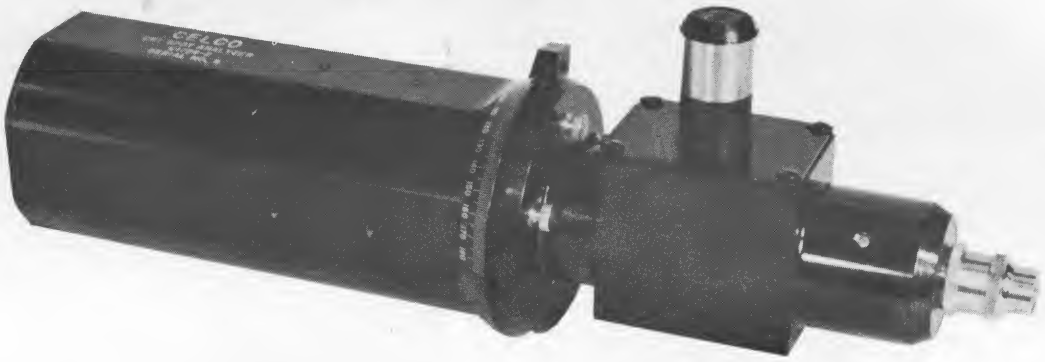
High Resolution Flying Spot Scanners Camera Tube Deflection

Information Retrieval Computer Displays Special Monitors

Call or Write for Engineering Application Information

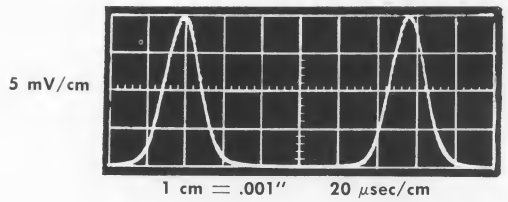
PRECISION Celco COMPONENTS

THE TWO-SLIT SPOT ANALYZER

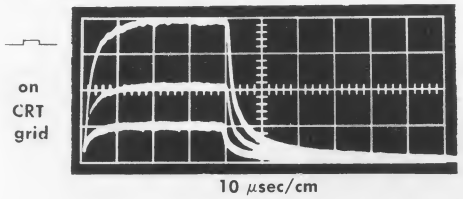


TYPICAL MEASUREMENTS ON A FLAT FACE CRT

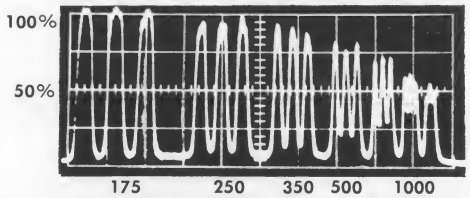
HALF AMPLITUDE SPOT DIAMETER



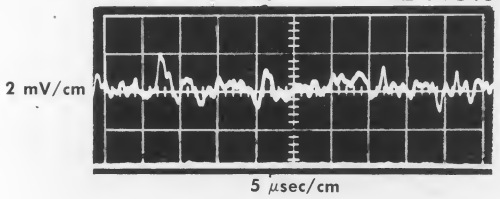
PHOSPHOR RISE and DECAY TIME



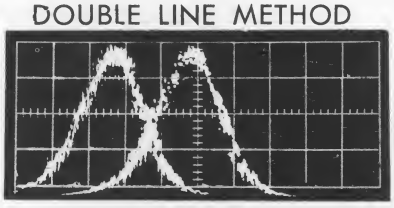
CONTRAST RATIO BAR CHART



P11 PHOSPHOR or FACE NOISE

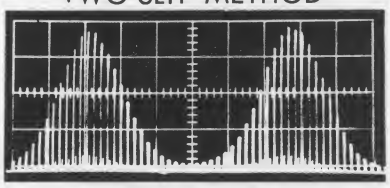


DOUBLE LINE METHOD



(2 line raster parallel to single slit)
3 sweep signals needed, raster must be moved vertically. Measurement of line spacing must be made on CRT face

TWO-SLIT METHOD



(Single line raster parallel to slit pair)
Only 2 sweep signals required.
Distance calibration is locked into analyzer. No measurement on CRT face

Celco

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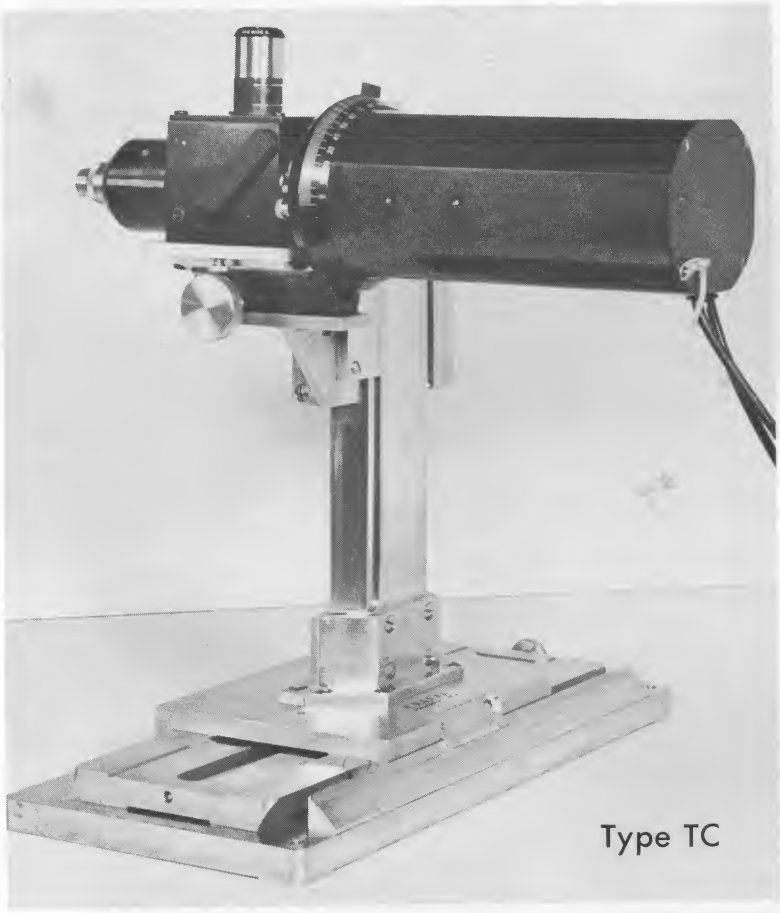
DISPLAY MEASUREMENTS LABORATORY



Mechanical Scan
Hand Position and Lock

Rapid Traverse
No Slow Cranking

X-Y Positioning
7″ x 7″ Field

Vernier Positioning
To .001″

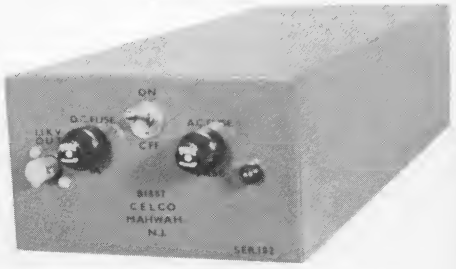
Z Positioning
Smooth Easy Focusing

The CELCO Two-Slit Analyzer mounted on the CELCO X-Y Traverse provides a precision instrument that enhances the capabilities of both your CRT Displays Laboratory and Production Control Department. With this combination the operator may rapidly position the analyzer and focus on the display area involved. Spot size measurements and X-Y coordinates are quickly obtained. Linearity and positional accuracies are easily measured. The Design Engineer may now make calculations and design decisions based on objective data.

POWER PACKAGE FOR TWO-SLIT SPOT ANALYZER

—1100V COMPLETELY SOLID STATE

- **Regulated for swings from 105V to 129V**
- **Pre-set —1100V output**
- **On-Off switch is only control**
- **No damage from shorting outputs**
- **Drops to 50V in 2.5 sec. when switched off**
- **Effectively shielded**
- **Size: 5″ x 3″ x 13″**



The CELCO B1887 Power Package has been specifically designed to operate the Two-Slit Spot Analyzer.

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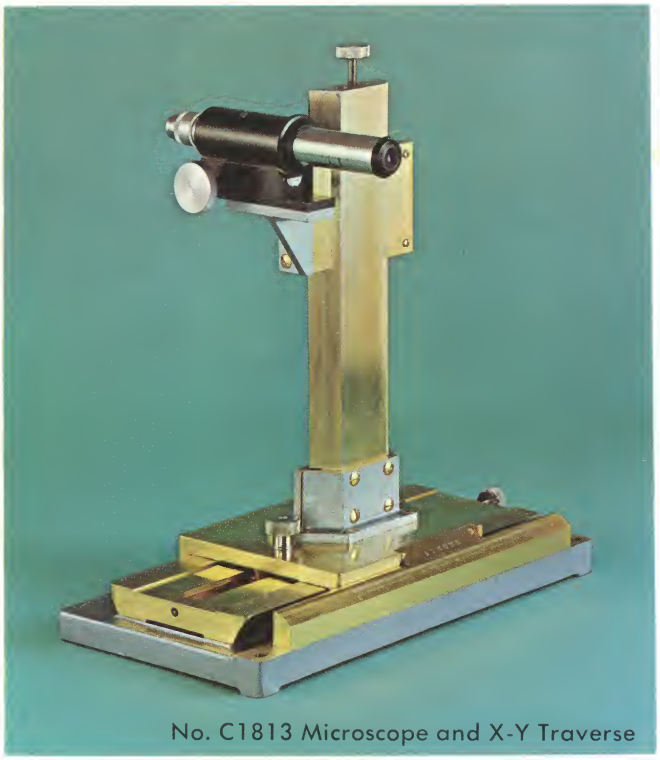
PRECISION Celco COMPONENTS

X-Y TRAVELING MICROSCOPE

NEW X-Y TRAVELING MICROSCOPE

For CRT Spot Examination

Vernier Readings to .001″



No. C1813 Microscope and X-Y Traverse

- **Inspect and Measure Simultaneously**
- **No Contact with CRT Face**
- **No Field Interaction**
- **Easily Carried, Easily Set Up**
- **Wide, Solid Base for Extra Stability**
- **Inch or Metric Systems**
- **Choice of Objectives**

A highly accurate instrument for measuring CRT yoke linearity, resolution, hysteresis and for establishing absolute references on the CRT face. Ruggedly constructed of non-magnetic alloys. Features dependable repeatability and a full 7″ of easy, rapid X-Y traverse.

No. C2051 Microscope and Focus Adjustment

The CELCO X-Y Traveling microscope is a versatile tool for laboratory and industrial inspection. The micrometer adjustments permit easy and precise measurement of length, stretch, creep, expansion, manometer liquid levels and other physical phenomena. The rugged construction allows extensive use with no loss of accuracy.

Celco YOKES

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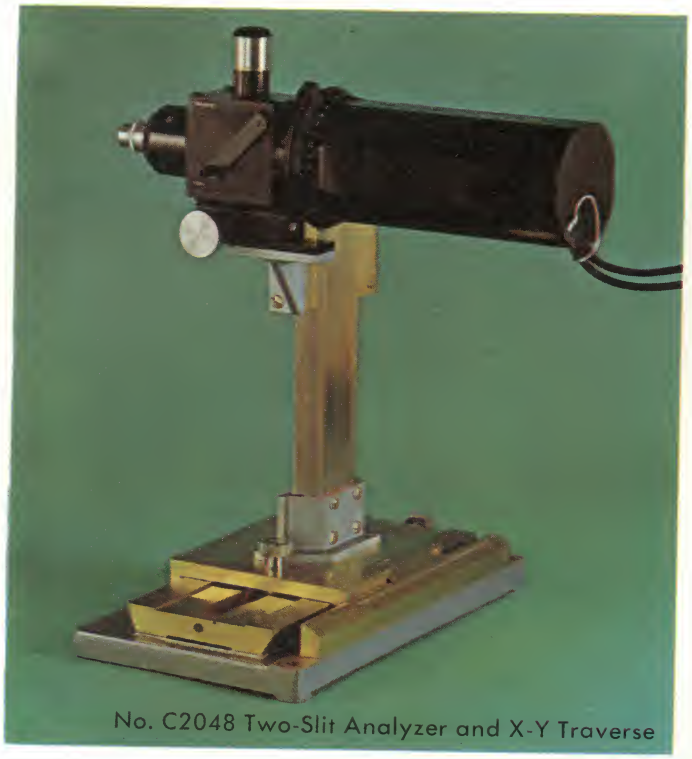
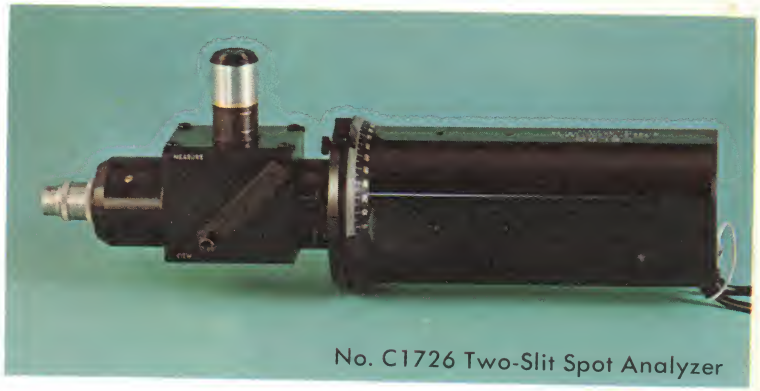
DISPLAY MEASUREMENTS LABORATORY



No. C2048 Two-Slit Analyzer and X-Y Traverse

No. C1981 Base and Column



No. C1726 Two-Slit Spot Analyzer

No. B2050 Focus Adjustment

The CELCO Two-Slit CRT Spot Analyzer is a precision device for measuring spot size on the face of high resolution CRTs under dynamic conditions and without dependence on operation function or eye fatigue. This instrument provides for the determination of spot characteristics through an oscilloscope display. Spot diameters at the half-amplitude values may be accurately measured to two microns for a .001" spot. All areas of the CRT face may be examined for spot growth or aberrations and phosphor noise may be evaluated at various spot velocities. The Two-Slit Analyzer may be mounted on the X-Y Traverse for convenient and exact spot following and locating.

Celco YOKES

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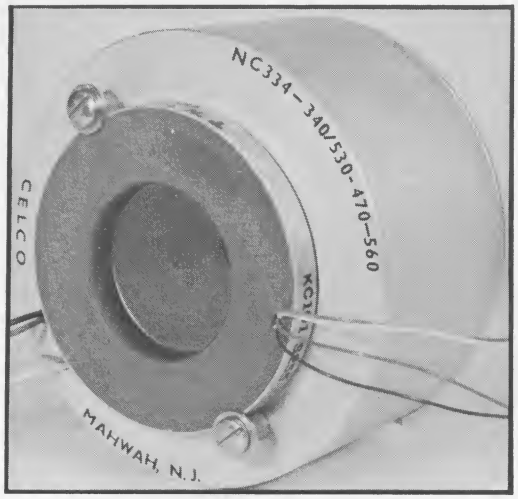
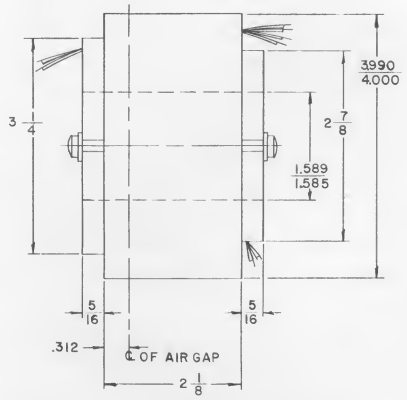
PRECISION Celco COMPONENTS

Magnetic Lens Assembly

NC334-265/620-470-560

MAGNETIC LENS
for
High Resolution CRT's





MAGNETIC LENS ASSEMBLY
PART NO. NC334-265/620-470-560

The assembly consists of basic CELCO components.

Static and Dynamic Coil — HLF334-265/620
Static Astigmatic Corrector — AC301-S470
Dynamic Astigmatic Corrector — DC301-S560

High resolution CRT's using electromagnetic deflection and focussing may well require the use of the CELCO Magnetic Lens Assembly to produce optimum results.

Tube manufacturers usually specify CRT performance at the center of the tube face. Here the focussed spot may meet the specifications, but careful examination of the undeflected spot will show astigmatism, precluding the realization of prime performance. Further distortion will be introduced by the deflection yoke, focus coil and the addition of deflecting and focus fields into the electrostatic fields of the CRT gun. Misalignment of the magnetic components relative to the electron beam may also be of importance. The CELCO Magnetic Lens Assembly was designed to offer the Display Engineer a novel (and sometimes the only) solution to these CRT problems.

Current Required

Static Focus Coil — Accurately regulated, low ripple, constant current D. C.

Dynamic Focus Coil — To be at desired sweep rates using appropriate functions for the particular CRT face. Correction for a flat face CRT is $KX^2 + KY^2 - kX^2Y^2$. (Several straight line functions may be used.)

Static Astigmatic Coil — Same as static focus coil.

Dynamic Astigmatic Coil — Appropriate current waveforms at the desired sweep rates, programmed for the correction required for the particular CRT-Yoke combination. (See box)

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MAGNETIC LENS ASSEMBLY

DYNAMIC ASTIGMATIC CORRECTOR

The cross over point where the electron beam converges in front of the aperture is not perfectly round. The purpose of the dynamic astigmatic corrector is to supply a controlled magnetic field to shape the electron beam.

At the center of the cathode ray tube a given field and field orientation can usually produce the required spot shape with the static astigmatic corrector. As the beam is deflected to either side of center, the field orientation must be changed to keep the spot anastigmatic.

The field orientation and magnitude can be achieved by supplying properly shaped currents at proper sweep speeds in the two sets of coils in the dynamic astigmatic corrector.

PROCEDURE

1. With aperture flooded, beam centered, yoke, focuser and pin-cushion assembly properly adjusted, pass rated D. C. current through "A" windings and observe spot. Adjust current for minimum astigmatism.
2. Adjust D. C. current in "B" windings for best spot.
3. Deflect spot ¼" and repeat above, recording "A" and "B" currents. Repeat for ¼" increments for 2".
4. Plot "A" and "B" currents versus distance and this will be the approximate wave shapes required to keep spot anastigmatic.

Sweep speeds must be compatible with your display sweeps.

Usual wave forms are parabolic on "A" and sine waves on "B" or vice versa depending on orientation and astigmatism correction required. Some CRT-Yoke combinations may require unusual correction functions.

COIL DATA AND ORDERING INFORMATION

Type Number NC334-265/620- 470- 560

Static and Dynamic Coil (Cat. Sheet F2A)
265 specifies Static Coil Resistance
620 specifies Dynamic Coil Inductance

Static Astigmatic Corrector
470 specifies Coil Resistance

Dynamic Astigmatic Corrector
560 specifies Coil Inductance

Basic Type	HF334-265/620		AC301-S470	DC301-S560
	Static	Dynamic		
Resistance	230 Ω	.11 Ω	75Ω	6.5 Ω
Inductance	2H	60 μH	2.5 mH	325 μH
Typical Currents	130 mA	2.7 A	0-100 mA	0-1 A

(other values on special order)

If the Dynamic Astigmatic Corrector is not required order:
NC334-265/620-470- Blank

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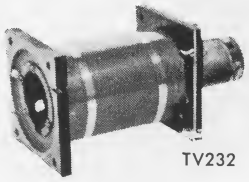
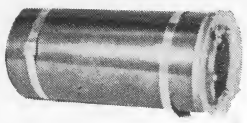
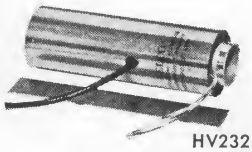
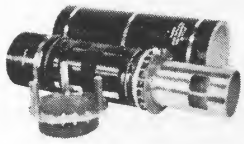
Celco TV CAMERA DEFLECTION COMPONENTS


TV232


BV232


HV232


TV348


IO680


AV172


DV348


ST212

1" VIDICON Magnetic Deflection, Focus and Alignment Coil Data

Coil Group No.	Type Number	Horiz. Induc. mH	Yoke Res. ohms	Vert. Induc. mH	Yoke Res. ohms	Focus Res. ohms	Align Res. ohms
	RECTANGULAR MOUNTING						
	Single-Ended						
A1*	TV232-S500/300-F240-A283	1.0	4.0	50	175	400	150
A3	TV232-S560/500-F240-A283	.25	1.0	1.0	4	400	150
	Push-Pull						
A2	TV232-P500-F240-A283	1.0	8.0	1.0	3.0	400	150
A4	TV232-P560-F240-A283	.25	2.0	.25	2.0	400	150
	CYLINDRICAL MOUNTING						
	Single-Ended						
B1	BV232-S620/600-F300-A283	.06	.5	.1	0.6	100	150
B3*	BV232-S500/300-F240-A283	1.0	4.0	50	175	400	150
B5	BV232-S410/300-F240-A283	8.0	27	50	175	400	150
B7	BV232-S440/340-F300-A341	4.0	20	40	160	100	10
	DIRECT DRIVE, HIGH RESOLUTION AND LINEARITY						
	Single-Ended						
C1	WV129-S500/350-F300-A283	1.0	4.0	32	175	100	150
C3	WV129-S620/-F240-A283	.06	.25	.06	.25	400	150
	Push-Pull						
C2	WV129-P450-F300-A283	3.0	30	3.0	30	100	150
C4	WV129-P560-F300-A283	.25	1.7	.25	1.7	100	150
	1" HYBRID VIDICON — Electrostatic Focus, Magnetic Deflection and Alignment Magnetic Shielding — Celcaloy						
	Single-Ended						
D1*	HV232-S509/345-A283	.80	4	35	125	—	150
D3	HV232-S560/362-A341	.25	2.5	24	96	—	10
	Push-Pull						
D2	HV232-P560-A283	.25	5.0	0.3	5.0	—	150
D4	HV232-P660-A341	.025	0.5	.03	0.5	—	10
	Single-Ended 1½" VIDICON — Magnetic Deflection, Focus and Alignment						
E1	TV348-S550-F330-A280	0.3	1	0.3	1	50	160
E3*	TV348-S450/352-F215-A280	3.0	12	3.0	90	700	160
	Single-Ended 1½" HYBRID VIDICON — Electrostatic Focus, Magnetic Deflection and Alignment						
K1	HV356-S550-A280	0.3	1	.3	1	—	160
K3*	HV356-S500/330-A280	1	3.5	50	185	—	160
	Single-Ended 2" IMAGE ORTHICON — Magnetic Deflection, Focus and Alignment						
F1	IO448-S500/352-F215-A280	1	3.5	30	90	700	160
F3	IO448-S450/352-F330-A280	3	12	30	90	50	160
	3" IMAGE ORTHICON — Magnetic Deflection, Focus and Alignment						
	Single-Ended						
G1*	IO680-S480/352-F174-A314	1.4	5	30	40	1850	75
G3	IO680-S660/540-F390-A316	.025	.08	.4	.8	15	70
G5	IO680-S599/352-F360-A314	.11	.3	30	40	20	75
	Push-Pull						
G2	IO680-P525/515-F360-A314	.54	1.7	.66	1.7	25	75
G4	IO680-P660/540-F390-A316	.025	.2	.4	2.	15	70
	3" IMAGE ORTHICON — Direct Drive, High Resolution and Linearity						
L1	AV172-S560/500-F285-A260	.25	1	1	2.5	150	25
L2	AV172-P600-F195-A310	.10	.7	.1	.7	75	250
	IMAGE DISSECTOR — Single-Ended						
H1	DV348-S550-F330-A280	.3	1	.3	1	50	160
H3	DV348-S450/352-F215-A280	3	12	30	90	700	160
	STAR TRACKER — Single-Ended						
J1	ST212-S360	25	40	25	40	—	—
J2	ST212-S450	3	5	3	5	—	—

*Standard Stock Items

A wide range of resistances and inductances are available. Special Vidicon, Dissector, Uvicon, Permachon, Plumbicon and other immersion optics tube coils on request. ½" Vidicon coils to your specifications. Space environment camera coils as for Ranger, Apollo, LEM, Tiros, Nimbus, etc.

Constantine Engineering Laboratories Company

Mahwah, N. J. 201-327-1123 Upland, Cal. 714-982-0215

PRECISION Celco COMPONENTS

DRIVERS

Type RDA-PP6N-1

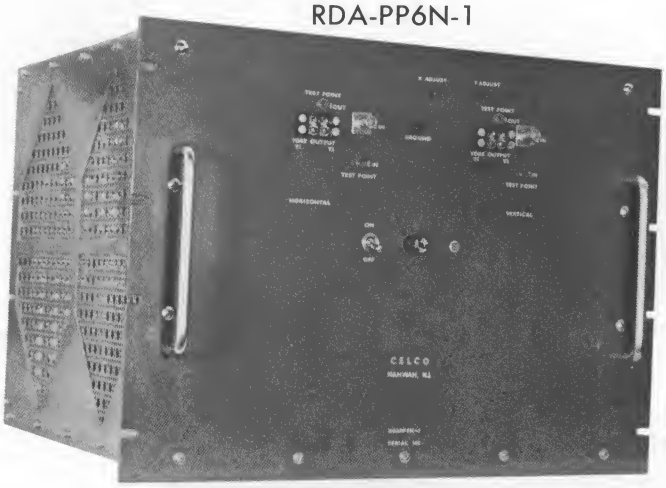
FAST
± 40 VOLT
ALL SILICON DEFLECTION DRIVERS

THE NEWEST, FASTEST STANDARD AMPLIFIER IN THE CELCO LINE

12 Amp Change in less than 9 μsec

0.02% linearity

RDA-PP6N-1



Deflection Amplifier and Regulated Quadru–Power Supplies with Safety Current Limiting·

- **Direct Conversion: E in to I out**
- **dc to Pulses and Complex Waveforms**
- **Compatible with Single-Ended Yokes**
- **No Synthesizing Networks Required**
- **Self Contained, Needs only 115 Vac**
- **Minimum Crosstalk**
- **Convenient Monitoring Points**
- **Saves Engineering Costs**
- **Reduce Prototype Lead Times**
- **Low Ripple**

SPECIFY CELCO YOKES AND AMPLIFIERS

Radar

Experimental and Development Projects

High Resolution Flying Spot Scanners Camera Tube Deflection

Information Retrieval Computer Displays Special Monitors

Call or Write for Engineering Application Information

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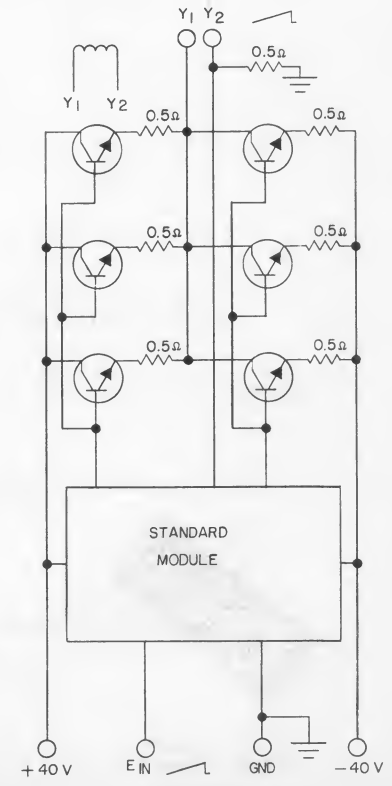
± 40 VOLT ALL SILICON DEFLECTION AMPLIFIER
MODEL RDA-PP6N-1
with
REGULATED POWER SUPPLY

	CHARACTERISTICS
POWER INPUT	115V 60Hz 8A
SOURCE IMPEDANCE	Specified at 1 Kohm for most applications. Source must be capable of supplying 100 μA base current plus 10K loading
INPUT IMPEDANCE	Input shunted with 10K resistor. Optimum source impedance is function of yoke impedance. Consult our Engineering Dept. regarding your application.
SIGNAL AMPLITUDE	± 3.0 volts
SIGNAL INPUT WAVEFORMS	dc to pulses, sawtooth, sine, square, writing strokes, resolved sweeps, random positioning and complex waveforms. Combinations of above may be summed at input.
OUTPUT CURRENT THROUGH YOKE	± 6 amperes, 12 amperes P-P
dc LINEARITY	± 0.02%, best straight line
STEP RESPONSE	Depends on yoke inductance. $T\ (\mu s) = \frac{L\ (\mu H) \times I\ (amps)}{E\ (volts)}$ ± 1.0 μsec E = 35V
FLYBACK TIME	Typically same as step response. (Less than 10 μsec for 12 amp change into 25 μH yoke)
SWEEP LINEARITY	Function of yoke inductance and fastest sweep. (See oscillograms on CELCO Sheet A3)
SMALL SIGNAL SINE WAVE RESPONSE	Flat within 3 db from dc to 250 KHz at 250 mA P-P with 25 μH yoke and source impedance of 1 Kohm. Feedback control adjusted for optimum.
OPERATING TEMPERATURE RANGE	± 6.0 amps, 50% duty cycle; 0-50°C ± 6.0 amps, dc; 0-25°C ± 5.0 amps, dc; 0-50°C
TEMPERATURE DRIFT	0-50°C, 0.2 mA/°C
MECHANICAL DATA	Width 19" Height 14" Depth 15¾" Weight 95 lb.
ELECTRICAL DATA	Three prong plug with ground

CELCO Solid State Amplifiers, Deflection Yokes and Focus Coils comprise an integrated group of high performance components for CRT beam control.

SPECIAL DESIGNS TO CUSTOMER REQUIREMENTS

- **Separate Power Supply and Amplifier for O.E.M.**
- **Special Voltages for Special Scans**
- **Special Responses and Current Ranges**
- **Special Input Circuitry for Voltage Clipping, Centering, Wave Shaping, Linearity Correction**
- **MIL Version to Customers Negotiated Requirements**
- **400 Cycle Inputs**



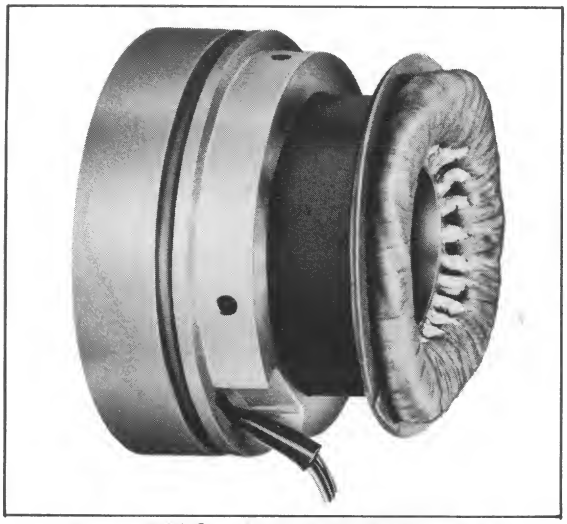
PRECISION Celco COMPONENTS

TYPE AY
1-7/16" CRT NECK
52° 70° 90°

DEFLECTION YOKES

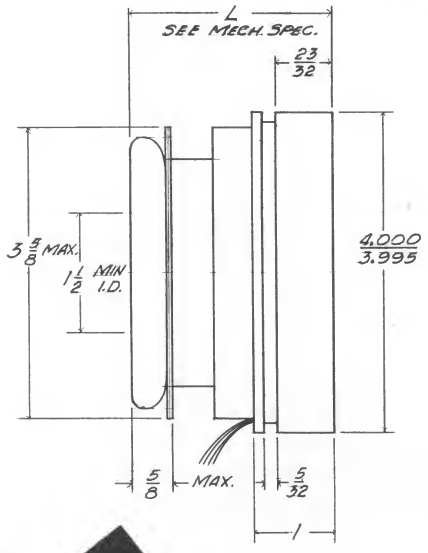
An Original Celco Design

THE STATOR YOKE THAT REVERSED THE EXPERTS



Type AY for 1-7/16" CRT Neck

DEFLECTION ANGLES	52°	Type AY521
	70°	Type AY716
	90°	Type AY912



When the vogue was saddle yokes, square yokes and toroid yokes, Celco pioneered the precision Stator Yoke.

These classic Celco Type AY standard deflection yokes are specified in military and commercial systems where uncompromising characteristics of precision and reliability must be assured.

Predominant in precision radar and superior quality CRT displays.

Performance Proven in the Field—Since 1950.

Compatible with Celco Solid State Amplifiers.

SPECIFICATIONS

ELECTRICAL

Residual	.08% max.
Perpendicularity	±.25°
Colinearity (Push Pull)	±.25°
Linearity I ∝ sin θ	.1% max.
Breakdown Voltage	1500 volts
Distributed Capacitance	90-250 pfd

MECHANICAL

Type	Deflection Angle	Weight (lbs.)	Length Inches
AY521	52°	2.5	2-13/16
AY716	70°	2.3	2-1/2
AY912	90°	2.1	2-3/8

8 leads — Push-Pull
8 leads — Single Ended
Other configurations on request

Celco

Constantine Engineering Laboratories Company

"For the latest in the science of Electron Beam Control"

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TWX 714 556 9550

SOUTHERN DIVISION
Miami, Florida
Area code: 305 PLaza 1-1132

EASTERN DIVISION
Mahwah, New Jersey
Area code: 201 DAvis 7-1123
TWX 201 327 1435

DEFLECTION YOKES

TYPE AY FOR 1-7/16" CRT NECKS

DEFLECTION COIL DATA WITH 10KV ON ANODE

Type No.	Inductance 1 KC Millihenrys	Resistance Ohms	Current to Deflect 1 Radius Amperes	*Recovery time Microseconds
PUSH-PULL HALF AXIS (Red/Blue)				
26° DEFLECTION				
AY521-P660	.025	.20	6.0	< 1
P600	.100	0.6	3.0	< 1
P560	.250	1.0	1.82	< 1
P500	1.0	2.5	.870	1.2
P450	3.0	6	.520	2.3
P400	10.0	20	.275	4.5
P340	40.0	90	.148	10.0
P300	100.0	150	.094	18.5
P250	320.0	450	.051	35.0
35° DEFLECTION				
AY716-P660	.025	.3	8.50	< 1
P600	.100	0.6	4.25	< 1
P560	.250	1.0	2.68	< 1
P500	1.0	2.5	1.33	1.1
P450	3.0	8	.740	2.2
P400	10.0	20	.405	4.3
P340	40.0	80	.205	9.8
P300	100.0	230	.130	18.3
P250	320.0	420	.073	34.7
45° DEFLECTION				
AY912-P660	.025	.25	12.0	< 1
P600	.100	.55	5.8	< 1
P560	.250	1.0	3.68	< 1
P500	1.	3.5	1.85	1.0
P450	3.	8.	1.08	2.1
P400	10.	15	.590	4.2
P340	40.	195	.300	9.7
P300	100.	320	.190	18.2
P250	320.	575	.106	34.6
SINGLE-ENDED HALF AXIS (Green/Yellow)				
26° DEFLECTION				
AY521-S660	.025	.10	6.0	< 1
S600	.100	.30	3.0	< 1
S560	.250	.5	1.82	< 1
S500	1.0	1.3	.870	1.2
S450	3.0	3	.520	2.3
S400	10.0	10	.275	4.5
S340	40.0	45	.148	10.0
S300	100.0	75	.094	18.5
S250	320.0	225	.051	35.0
35° DEFLECTION				
AY716-S660	.025	.15	8.50	<1
S600	.100	.3	4.25	<1
S560	.250	.5	2.68	<1
S500	1.0	1.3	1.33	1.1
S450	3.0	4.0	.740	2.2
S400	10.0	10.0	.405	4.3
S340	40.0	40.0	.205	9.8
S300	100.0	115.0	.130	18.3
S250	320.0	210.0	.073	34.7
45° DEFLECTION				
AY912-S660	.025	.13	12.0	< 1
S600	.100	.28	5.8	< 1
S560	.250	0.5	3.68	< 1
S500	1.0	1.8	1.85	1.0
S450	3.0	4.0	1.08	2.1
S400	10.0	7.5	.590	4.2
S340	40.0	98.0	.300	9.7
S300	100.0	160.0	.190	18.2
S250	320.0	288.0	.106	34.6

*Recovery Time Values refer to coil current to 99.0% decay, yoke critically damped, with 15 pfd plate lead stray capacitance. For special applications where a lower residual is required, consult your Celco Engineer.

Printed in U. S. A.

SPECIFY YOUR OWN INDUCTANCES

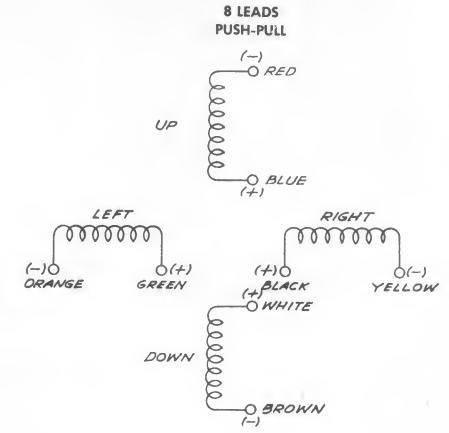
The inductances listed at left are merely representative of Celco AY yokes. Any inductance value called for in your specifications can be supplied immediately.

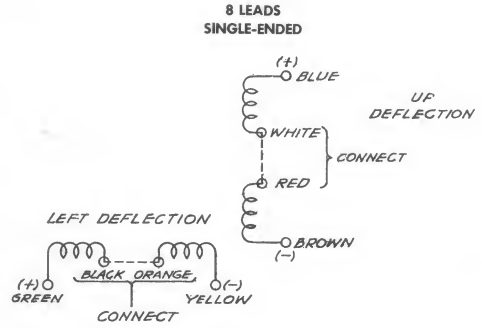
Inductance ratios—Push-Pull

Vertical Up/Nominal	±10%
Vertical Down/Vertical Up	.83
Horizontal Left/Vertical Up	1.08
Horizontal Right/Vertical Up	.90

Single-Ended

Horizontal (Listed)	10%
Vertical/Horizontal	1.15





To determine yoke data for deflection angles, anode voltages and inductances not listed, or for Celco Yoke-Amplifier Combination performance, see your Celco Catalog Application Notes. Refer to Conversion Computations and Deflection Driver pages, A1, A2, and A3.

Celco AY Deflection Yokes may be used with Celco Solid State Deflection Amplifiers.

The Celco Sales Engineer in your area will welcome an opportunity to discuss special applications or modifications of standard units to meet your design requirements.

LOW LI²
DEFLECTION YOKES

TYPE
FY
HIGHEST
SENSITIVITY

Celco

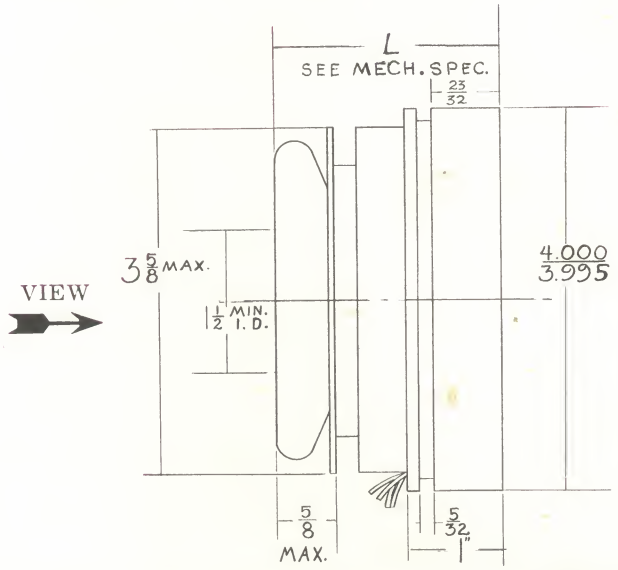
CELCO TYPE "FY" DEFLECTION YOKES DESIGNED FOR MAXIMUM SENSITIVITY

for 1-7/16″ Cathode Ray Tube Neck Diameters

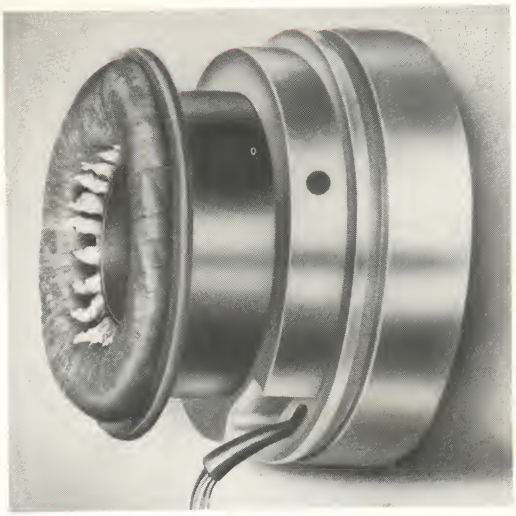
TYPE FY444 — DEFLECTION ANGLES TO 42°
TYPE FY536 — DEFLECTION ANGLES TO 52°
TYPE FY727 — DEFLECTION ANGLES TO 70°
TYPE FY920 — DEFLECTION ANGLES TO 90°

- Maximum effective yoke length without neck shadow
- Transistor or vacuum tube drive
- Wide range of inductance and resistance
- Highest efficiency — lowest inductance for minimum LI²
- Low Residual — 0.1%
- Precision fabrication of special magnetic alloys
- CELCO precision atmosphere annealing of magnetic alloys
- Precision control of magnetic characteristics
- Precision winding of evaluated coil distributions

CELCO "FY" Deflection Yokes may be used with **CELCO DRIVERS,** PDA-PP2 or PDA-PP3, 2 or 3 Amp Solid State Deflection Amplifiers (See "FY" Driver-Yoke Curves Page A4)



For application assistance call or write your nearest CELCO Manufacturing Facility listed below.



Type "FY" Yoke
for 1-7/16″ CRT Neck Diameter

SPECIFICATIONS

ELECTRICAL

Residual	.1% Max.
Perpendicularity	± .5°
Colinearity (Push-Pull)	± .5°
Linearity I ∝ Sin θ	.1% Max.
Breakdown Voltage	1500 Volts
Distributed Capacitance	90-250 pfd.

MECHANICAL

Type	Def. Angle Degrees	Weight Lbs.	Length (L) Inches
FY444 —	42	2.9	3 15/16
FY536 —	52	2.5	3 7/16
FY727 —	70	2.3	2 5/8
FY920 —	90	2.1	2 3/16

Outside Diameter 4.000″ / 3.995
Inside Diameter 1½″ Min.

8 Leads — Push-Pull
4 Leads — Single-Ended
Other Leads on Request

Celco *Constantine Engineering Laboratories Company*

"For the latest in the Science of Electron Beam Deflection"

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Upland, Cal. Bob Reese
Area Code: 714 YUkon 2-0215
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SINGLE-ENDED DEFLECTION COIL DATA

Full-Axis Winding Data (Orange/White to Orange)

10 KV ACCELERATING POTENTIAL

1-7/16" CRT Neck Diameters

Type No.	‡Inductance 1 KC Millihenrys	Resistance OHMS	Current to Deflect 1 Radius Amperes	*Recovery time Microseconds
		42° CRT		
FY444-S660	.025	.05	2.8	< 1
FY444-S620	.06	.1	1.85	< 1
FY444-S600	.1	.15	1.4	< 1
FY444-S560	.25	.5	.9	< 1
FY444-S500	1	1.3	.46	1.5
FY444-S400	10	14	.15	4
FY444-S320	32	44	.082	8
		52° CRT		
FY536-S660	.025	.06	4.2	< 1
FY536-S620	.06	.13	2.64	< 1
FY536-S600	.1	.2	2.1	< 1
FY536-S560	.25	.5	1.32	< 1
FY536-S500	1	1.5	.66	1.8
FY536-S400	10	15	.21	4.5
FY536-S320	32	50	.12	9
		70° CRT		
FY727-S660	.025	.05	7.0	< 1
FY727-S620	.06	.12	4.5	< 1
FY727-S600	.1	.2	3.5	< 1
FY727-S560	.25	.5	2.2	< 1
FY727-S500	1	1.9	1.1	< 2
FY727-S400	10	18	.35	5
FY727-S320	32	60	.19	10
		90° CRT		
FY920-S660	.025	.07	9.5	< 1
FY920-S620	.06	.17	6.2	< 1
FY920-S600	.1	.45	4.8	< 1
FY920-S560	.25	.8	3.0	< 1
FY920-S500	1	2.3	1.5	2.5
FY920-S400	10	22	.5	6
FY920-S320	32	62	.28	11

PUSH-PULL DEFLECTION COIL DATA

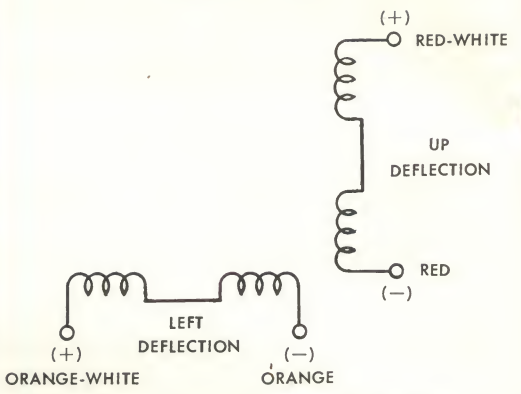
Half-Axis Winding Data (Brown/White to Brown)

10 KV ACCELERATING POTENTIAL

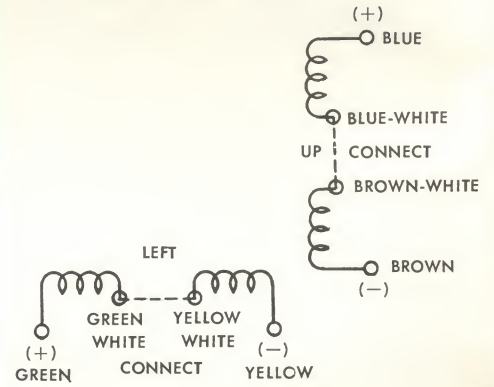
42° CRT

FY444-P660	.025†	.09	2.8	< 1
FY444-P620	.06	.2	1.85	< 1
FY444-P600	.1	.3	1.4	< 1
FY444-P560	.25	.9	.9	< 1
FY444-P500	1	2.5	.46	1.5
FY444-P400	10	28.	.15	4
FY444-P320	32	88.	.082	8
		52° CRT		
FY536-P660	.025	.1	4.2	< 1
FY536-P620	.06	.25	2.6	< 1
FY536-P600	.1	.4	2.1	< 1
FY536-P560	.25	1.	1.32	< 1
FY536-P500	1	3.	.66	1.8
FY536-P400	10	30	.21	4.5
FY536-P320	32	100	.12	9.
		70° CRT		
FY727-P660	.025	.1	7.0	< 1
FY727-P620	.06	.3	4.5	< 1
FY727-P600	.1	.5	3.5	< 1
FY727-P560	.25	1.2	2.2	< 1
FY727-P500	1	3.7	1.1	2.0
FY727-P400	10	36	.35	5
FY727-P320	32	115	.19	10
		90° CRT		
FY920-P660	.025	.15	9.5	< 1
FY920-P620	.06	.35	6.2	< 1
FY920-P600	.1	.7	4.8	< 1
FY920-P560	.25	1.5	3.0	< 1
FY920-P500	1	4.5	1.5	2.5
FY920-P400	10	44	.5	5
FY920-P320	32	125	.28	11

SINGLE-ENDED
4 Leads (Standard)

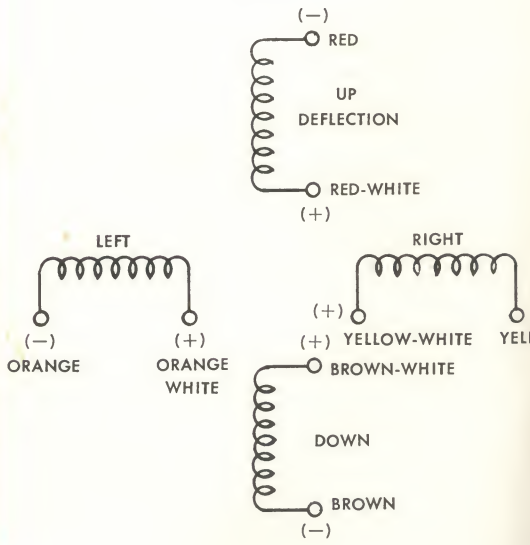


SINGLE-ENDED
8 Leads (Special)



‡ Horizontal Inductance is Listed
Vertical Inductance = 1.14 × Horiz. Ind.

PUSH-PULL
8 Leads (Standard)



† Vertical Down Inductance Listed
Vertical Up = 1.18 × Vert. Down
Horizontal Left = 1.3 × Vert. Down
Horizontal Right = 1.07 × Vert. Down

* Recovery Time Values refer to Coil Current to 99.0% Decay, Yoke Critically Damped, with 15 pfd Plate Lead Stray Capacity. Where lower Residual is required consult our Engineering Dept.

Distributed Capacitance: 90 to 250 pfd.

PRECISION Celco COMPONENTS

Ultra High Resolution

Deflectrons®

DEFLECTION YOKES

for PRECISION DEFLECTION of CRT ELECTRON BEAMS

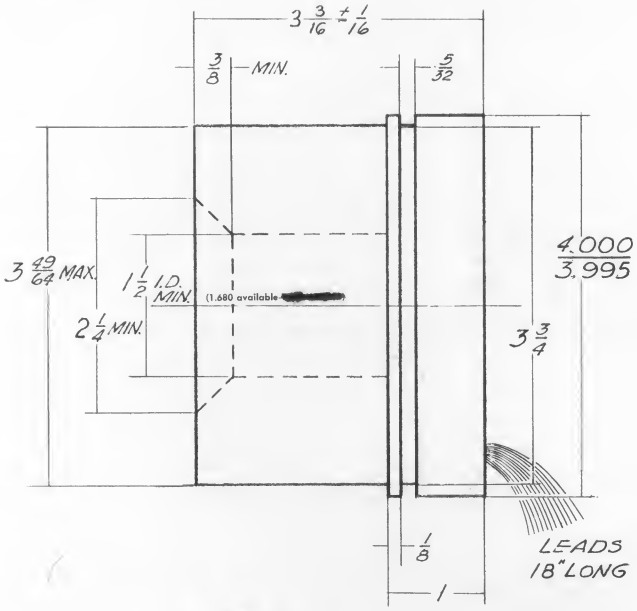
MORE INFORMATION PER UNIT AREA PER UNIT TIME

DEFLECTRON®
Type HD428
For 42°, 1-7/16" neck CRT's

Fastest Recovery — To 0.1% in 10μs

Smaller Spots — By 25%

Radar Displays
Computer — Dot, Alpha-Numeric
Line Scans
Scan Converters
Spiral Scans
Quality Monitors
Tactical Display Systems
Readout Systems
Astronomical and Satellite Displays



Now! A uniform field ferro-magnetic core deflection yoke that minimizes spot defocusing and permits recovery to 0.1% in 10μs; to 1.0% in 1.5μs

CELCO engineering and material technology add a new dimension in precision deflection of electrom beams for all types of high resolution CRT displays

PERFORMANCE PARAMETERS

	STANDARD	SPECIAL
Perpendicularity	±0.2°	0.1°
Colinearity	±0.2°	0.1°
Residual Magnetism	0.05%	0.025%
Linearity	±0.1%	0.05%
Breakdown Voltage	1500V	

8 or 12 color-coded leads — at back, down at 6 o'clock.
Other lead dress on request.
Special orders to meet MIL-C-18388.

Celco

Constantine Engineering Laboratories Company

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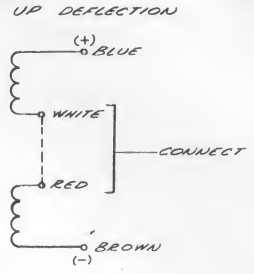
EASTERN DIVISION
Mahwah, New Jersey
Area code: 201 DAvis 7-1123
TWX 201 327 1435

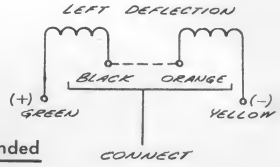
Deflectron® Type HD428

for ULTRA HIGH RESOLUTION 42° CRT's 1-7/16 NECK

PUSH-PULL COIL DATA FOR 21° DEFLECTION WITH 20KV ON ANODE.
HALF-AXIS VALUES Red-Blue

Type No. HD428	†Inductance at 1 kHz mH	Max. Resist. Ohms	Current Amps Id	Sweep Time for 100V Induced Yoke Voltage μs	*Spot Recovery time to 1% μs	*Spot Recovery time to 0.1% μs	Distributed Capacitance Max.pF
—P660	.025	.15	6.3	1.55	1.4	9	60
—P620	.06	.4	4.0	2.4	1.5	9	75
—P600	.100	.5	3.2	3.2	1.8	10	85
—P560	.25	1.0	2.0	5.0	2.0	10	95
—P530	.50	1.6	1.4	7.5	3.0	14	100
—P500	1.0	2.5	1.0	10.	4.0	16	125
—P450	3.0	8.0	.56	17.4	5.0	20	150
—P400	10	25	.30	30	12	30	200
—P350	32	80	.17	55	22	50	250
—P300	100	300	.092	95	40	100	300
—P520	320	900	.054	170	80	200	350

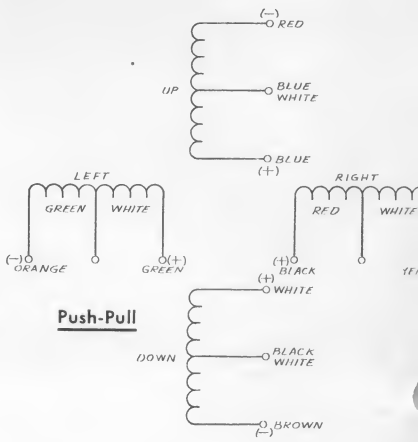




Single Ended

SINGLE-ENDED COIL DATA FOR 21° DEFLECTION WITH 20KV ON ANODE.
FULL-AXIS VALUES Green-Yellow

HD428—							
—S660	.025	.08	6.2	1.55	1.4	9	60
—S620	.06	.15	4.0	2.4	1.5	9	75
—S600	.100	.4	3.2	3.2	1.8	10	85
—S560	.25	.5	2.0	5.0	2.0	10	95
—S530	.50	.8	1.4	7.5	3.0	14	100
—S500	1.0	1.3	1.0	10.	4.0	16	125
—S450	3.0	4	.56	17.4	5.0	20	150
—S400	10	13	.30	30	12	30	200
—S350	32	40	.170	55	22	50	250
—S300	100	150	.092	95	40	100	300
—S250	320	450	.054	170	80	200	350



Push-Pull

† Tabulated inductance value for Push-Pull is Vertical (up) and for Single Ended is Horizontal. Standard yoke coils are manufactured for minimum distributed and inter-coil capacitance resulting in unbalanced inductances. Sensitivities of each coil are equal.

Inductance Ratios: Push-Pull

Vertical (up) (tabulated)	± 10%
Vertical (down) / Vertical (up)	0.83
Horizontal (left) / Vertical (up)	1.08
Horizontal (right) / Vertical (up)	0.90

Inductance Ratios: Single Ended

Horizontal (tabulated)	±10%
Vertical/Horizontal	1.15

*Time for spot to recover on face of the CRT to 1% and 0.1% of initial deflection with optimum damping.
For high resolution applications it is important that the magnetic field in the yoke air gap decay to values consistant with the final presentation on the CRT face (see CELCO data sheet Y2A). Careful control of magnetic core alloy assures our customers of their desired spot recovery time. For those special cases where the above recovery times are inadequate, consult our Engineering Dept. Note. Any information regarding your application will be helpful to our designers. Use the Yoke Design sheets in our catalog.

PUSH-PULL
12 leads for optimum damping

Common (+ plus)	Tap	(— Negative)	Spot Deflection
Blue	Blue-White	Red	Up
White	Black-White	Brown	Down
Green	Green-White	Orange	Left
Black	Red-White	Yellow	Right

SINGLE-ENDED 8 leads

Connect			
Blue	White-Red	Brown	Up
Green	Black-Orange	Yellow	Left

(1) Linearity: Deflection Current (I_d) is proportional to the sine of the deflection angle.

(2) On flat faced CRT's the deflection distance $d = d_o + Ad_o^3$ resulting in a non-linear relationship between (I_d) and (d) approximately equal to the percentage difference between sine θ and Tan θ. See CELCO Application Note Y2C.

Combined Deflectron and 5" O. D.
Flat-faced CRT Performance

Deflection Degrees	Linearity on-axis
5	+0.7% Max.
10	+2.5% Max.
15	+ 4.0% Max.
20	+6.5% Max.

(Tube face geometric distortion)

(3) Pincushion can be corrected by using CELCO Deflectron HDE428 and Pincushion Correction Assembly. dc is required to operate correction coils. Linearity is increased by approximately 1% at 20° for note (2). Astigmatism may be corrected by using CELCO Magnetic Lens Assembly NC334.

(4) Actual spot growth will depend on the particular CRT, the beam bundle diameter in the yoke, inherent CRT-yoke astigmatism, focus coil astigmation and yoke inductance required. Consult our Engineering Dept.

Spot Growth (spot refocused) 1:1.3 Typical

Astigmatic Correctors Static and Dynamic

File under Deflectrons

Celco

Guarantee

CELCO, Constantine Engineering Laboratories Company, warrants each new component manufactured and sold by them to be free from defects in material and workmanship for a period of one year.

It is hereby understood that CELCO warrants only the components and the accessories manufactured by CELCO. CELCO makes no warranty with respect to the transistors, capacitors, resistors, electrical control equipment or other products not manufactured by CELCO, such being subject to the warranties of their respective manufacturers.

This warranty does not obligate CELCO to bear the cost of labor or shipping charges in connection with the replacement or repair of defective parts, nor shall it apply to any component upon which repairs or alterations have been made, unless authorized by the manufacturer or his authorized agent.

CELCO shall in no event be liable for consequential damages or contingent liabilities arising out of the failure of any component, its power supply or their accessories to operate properly.

No express, implied or statutory warranty other than herein set forth is made or authorized to be made by the manufacturer.

Returned Goods

Written permission must be obtained before returning any material for credit. Material so returned will be subject to a deduction for rehandling. All material returned must have shipping charges prepaid.

Products which are obsolete or made to special order are not returnable.

Performance Warranty

CELCO, Constantine Engineering Laboratories Company, long ago established the policy of giving our customers the best information possible with regard to performance of the components we manufacture.

The performance data given in this catalog and other published literature were derived from actual tests of standard production components, and reflect an average performance of the components indicated.